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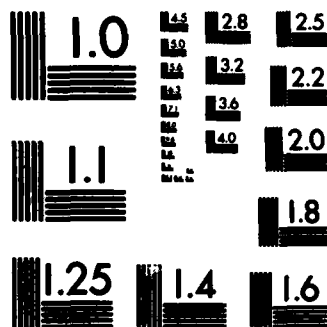
MIDGET SUBMARINES (KLEINST-U-BOOTE) (U) NAVAL
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MIDGET SUBMARINES

[Militaertechnik, No. 3, 1983, pp. 164-165, 170. GDR/ German translation of original Russian article by Captain 3rd Rank B. Tyurin]

Submarines with a displacement of less than 100 t are designated midget subamrines. Periodically articles about this type of submarine appear in the foreign press.

During WWII, midget submarines were used by the underwater diversionary forces. In the opinion of experts, they were extremely effective. In the early postwar years, interest in midget submarines subsided considerably. Only a few models were developed to test the suitability of technical solutions and tactical deployment. But in the '50s the construction of midget submarines was continued, since in the opinion of foreign experts they should handle better than conventional submarines in certain sea areas, e.g., in shallow coastal areas. Another advantage of the midget submarines is their relatively low construction and operational costs.

The missions to be performed with the help of midget submarines can be derived from reports in foreign military publications:

- safeguarding antisubmarine defense and action against surface ships,
- transport and landing of reconnaissance groups in the vicinity of naval bases, ports and anchorages of enemy ships,
- attacking ships at sea,
- covert minelaying in straits and on shipping routes, etc.

The boats are also to be equipped with an interchangeable armament, including mines, torpedoes and surface-to-surface rockets, and be able to transport frogmen. This requirement is especially underlined: any type of armament has to be exchangeable at sea, without docking.

According to reports in the foreign press, midget submarines are being built today in view of recent achievements in the realm of submarine construction. Nevertheless, these boats are not devoid of deficiencies. A major shortcoming for prolonged operation just below the surface is the extended and therefore revealing air intake stack which serves an an air intake for the diesel motor, as an exhaust for gases during recharging of the storage batteries, and for ventilation of the spaces. Improved storage batteries (less recharging time) are being used to reduce this deficiency. It is further anticipated that future propulsion units can be used without air supply from the atmosphere. One of the possibilities would be a unit based on fuel components.

According to NATO specialists, midget submarines operating in shallow coastal waters have to be especially maneuverable, have good seakeeping properties and an endurance of at least 10 days. It is further calculated

that these submarines are equipped with noise detectors whose detection range is comparable to the operating range of sonars aboard hostile ASW ships. There can also be equipment for underwater sonic communication on the boats.

Modern foreign midget submarines have a displacement of 40 to 80 t, a length of 16 to 25 m, a beam of 2.6 m, a draft of 4 m, and a diving depth down to 100 m. Maximum surface speed is 11 kn, underwater speed with electric drive 6.5 kn, and snorkeling with diesel motor 7 kn. Surface range is 1,600 nm, and 60 nm submerged. The endurance is listed at 12 days, with a crew of 4-6. Additionally, eight frogmen can be taken on board.

Foreign midget submarines resemble diesel submarines externally. Their design solutions in many cases originate from the design experiences and construction of normal submarines. Double-hulled and one-and-a-half-hulled submarines can be distinguished by their architectural and design type. Such a designation can be explained by the nature of the pressure hull. It is either completely (double-hulled submarines) or partially (one-and-a-half-hulled submarines) surrounded by an external hull for better seakeeping and to house the main and secondary ballast tanks. The steel pressure hull is common to both types. The inside back cover of this issue shows the architectural layout of the submarines.

A distinguishing characteristic of both types is the configuration of their outer hulls. The configuration of the one-and-a-half-hulled midget submarine resembles a teardrop. It is more favorable for underwater operation due to reduced water resistance. On the other hand, the configuration of the outer hull of a double-hulled boat comes closer to the contour of a surface ship and assures good seakeeping qualities both on the surface and submerged.

Structural peculiarities emerge in regard to the position and type of horizontal rudder on these submarines. Double-hulled boats have the horizontal bow rudder pair near the conning tower, while the one-and-a-half-hulled boats have extendable and retractable horizontal bow rudders located in the bow recesses. The peculiarity is that the starboard rudder is used for diving and the port rudder for surfacing. The angle of attack of both rudders is fixed. During high-speed submerged operation, the rudders are retracted into the recesses; steering is accomplished by the horizontal bow rudders. The configuration of the stern section of a one-and-a-half-hulled submarine is also atypical. On the stern there is a cross-shaped tail unit: one vertical and two horizontal stern rudders. According to foreign experts, such control surfaces best assure the steering of a teardrop-shaped submarine.

The pressure hulls of both types are subdivided into individual sections by two light, sound-impermeable bulkheads. The interiors are about the same: bow berthing area, middle control position, stern propulsion section. In the bow there is a stable wet chamber for deploying or recovering frogmen whenever the boat makes little underwater headway or lies on the bottom.

In the accommodation section (the crew and the frogmen are berthed here), systems and equipment are also usually set up. In the control center



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there is shiphandling equipment. The main motors for surface and submerged operation and the auxiliary units are housed in the propulsion section. The receiving antenna of the noise detector is usually in the bow section of the outer hull.

The driving motor on both types of boats is fed by storage batteries arranged in groups. The one-and-a-half-hulled boats have two storage battery groups in the bow section of the pressure hull, the bow and stern groups are housed in the smaller, lower cylindrical part of the pressure hull on the double-hulled boat. All midget submarines have several ballast tanks and other tanks. The pressure hulls are likewise set up for storing provisions and drinking water.

The armament for performing a combat mission determines the external configuration of the ship. The one-and-a-half-hulled boats have recesses on each side of the outer hull for torpedoes, bottom mines, transporters for frogmen, and/or containers. The double-hulled boats possess, for the aforementioned equipment, mounts on boat sides of the outer hull resembling the external stores mounts of an airplane. Anchor gear, mooring device, towing gear and rescue equipment are installed on midget submarines. Both types have stern propellers.

Performance and composition of the diesel-electric drive are similar. The main motor for surface operation of the one-and-a-half-hulled boat is an electric motor, for the double-hulled boat a diesel motor. The output of the diesels and diesel generators on these boats is several hundred kW. The propeller-electric motors for submerged operation (DC tandem motors) and the motors for surface operation are in the propulsion section. Next to these motors in the propulsion section (of the one-and-a-half-hulled boat) are the auxiliary units: air compressor, two bilge pumps, transformer, ventilators, etc.

In order to lower the noise level of one-and-a-half-hulled submarines, the driving motor and its drive are positioned on rubber shock absorbers, and the diesel generator is mounted on a damping frame and surrounded by a double sound-absorbent housing.

Both types have modern navigation and communications equipment and sonars: gyrocompass, autopilot, sonic depth finder, log, underwater communications, automatic direction finder, bathythermograph. The double-hulled boat has a portable radiotelephone, as well as an optical and TV periscope. The installation of additional equipment in the next few years is planned: (for double-hulled boats) noise detector, an obstacle warning device, a plotting board, log utilizing the Doppler effect, satellite communication, receivers for sonars and radars. ECM devices are also supposed to be aboard.

Several combat load variations are provided for double-hulled boats. Standard variants can take six large and 11 small explosive charges on board. The transporters carried on board the boats for the frogmen are a follow-on to the one-man torpedoes of WWII. They were made in light of the latest scientific and technical developments in submarine construction and light

diving equipment. The dimensions of such a transporter do not exceed those of a large explosive charge, its length is that of a normal torpedo. It can carry two frogmen with equipment or a heavy mine to about the diving depth of the submarine.

There have been statements in the foreign press concerning midget submarine designs which are said to have, in addition to the above-mentioned characteristics, an outer hull separable from the pressure hull. This design principle is supposed to facilitate large-series production. The crew is supposed to be able to assemble such a submarine under shipyard conditions as well as in the theater of operations.



Fig. 1. Possible variations of missions performed by midget submarines

- 1) Underwater diversion with the use of transporters;
- 2) Firing torpedoes at hostile ships;
- 3) Firing rockets;
- 4) Electronic reconnaissance;
- 5) Laying mines.

Architectural Types of Midget Submarines

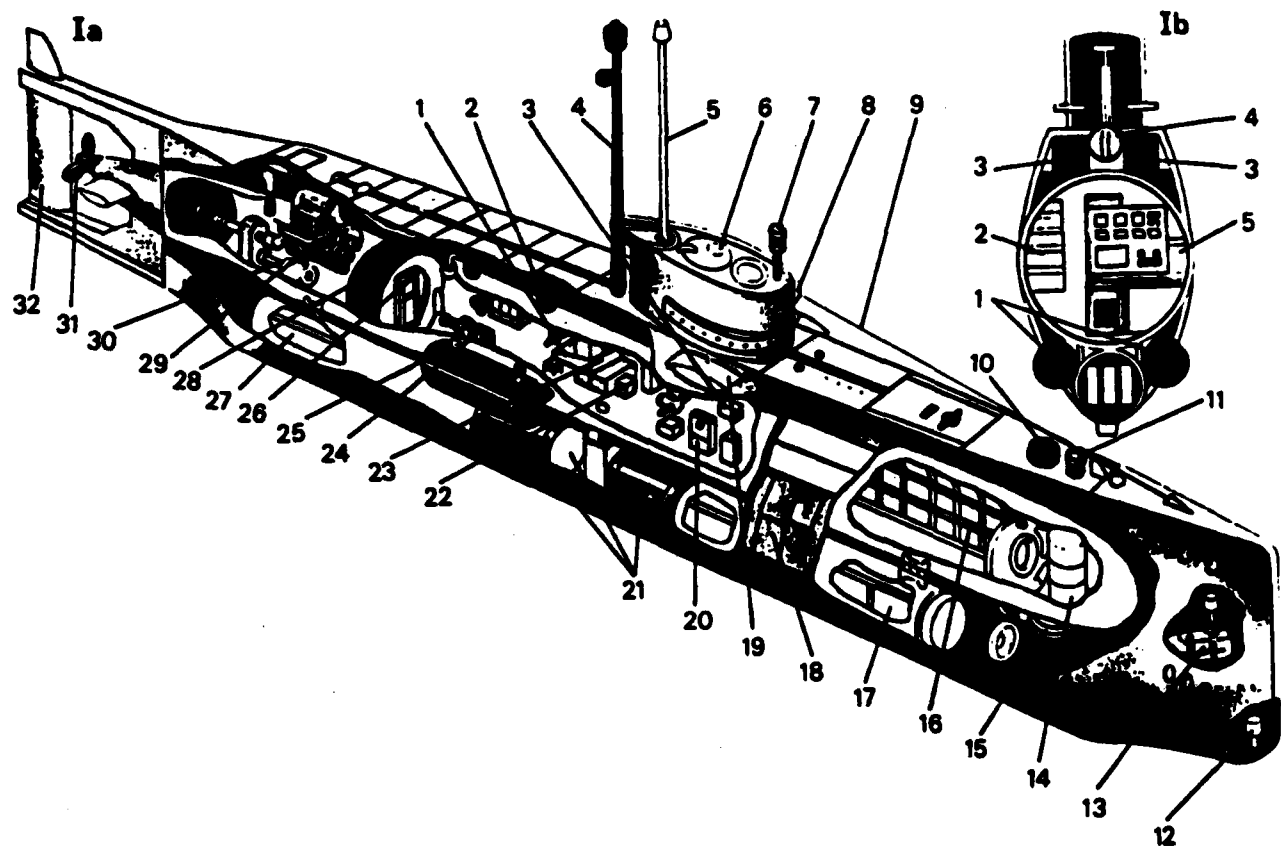
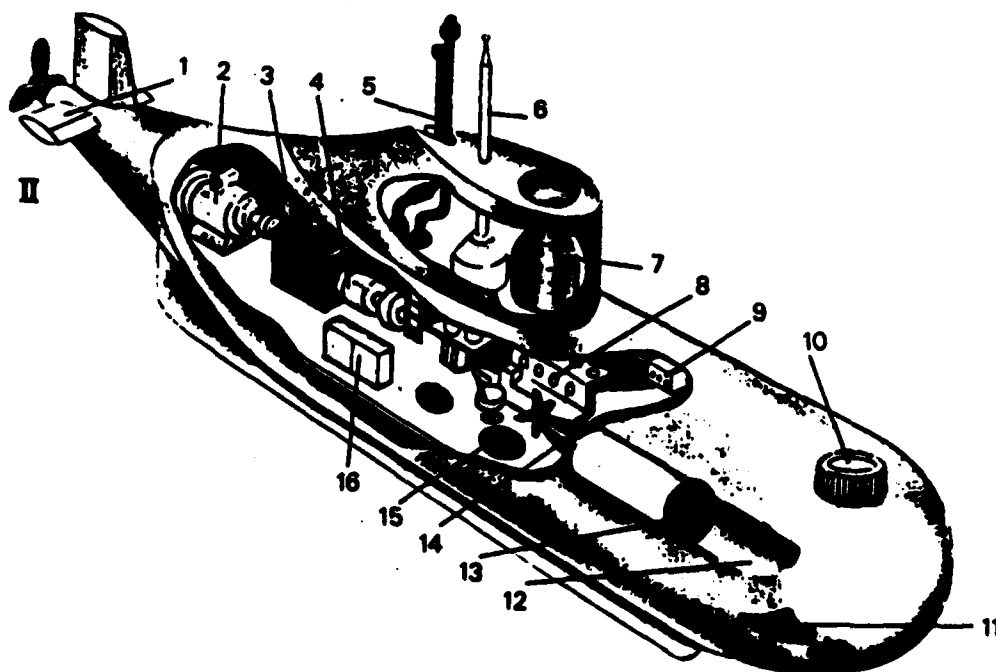


Fig. 2. I Double-hulled midget submarine: Ia--longitudinal cross-section (general layout): 1) control console of the the submarine, 2) small explosive charge, 3) sniffer, 4) snorkel, 5) optical periscope, 6) access hatch, 7) periscope for TV camera, 8) telephone for underwater communication, 9) antenna, 10) emergency life buoy, 11) receiving antenna of the sonar DF station, 12) transmitter of the warning system against collision with underwater obstacles, 13) bow-propeller-rudder system, 14) lock chamber, 15) wet chamber access, 16) accomodation spaces for the crew, 17) bow batteries, 18) eight disposable ballast blocks, 19) horizontal starboard bow rudder, 20) noise direction finder, 21) fuel and ballast tanks, 22) gyrocompass, 23) navigation position, 24) air purifier, 25) large starboard explosive charges, 26) control

station, 27) stern batteries, 28) fuel tank, 29) diesel motor, 30) electric motor, 31) screw, 32) vertical stern rudder.

1b--cross-section (rear view): 1) six large explosive charges (or two torpedo tubes or two transporters for frogmen), 2) trim pump system, 3) small explosive charge, 4) snorkel, 5) sniffer.



II. One-and-a-half-hulled midget submarine: 1) horizontal stern rudder, 2) main propulsion electric motor, 3) diesel motor, 4) generator, 5) snorkel, 6) periscope, 7) pressurized conning tower, 8) control station, 9) sonar amplifier, 10) sonar antenna, 11) horizontal starboard bow rudder, 12) wave breaker, 13) starboard torpedo tube, 14) torpedo, 15) compensation tank filler neck, 16) main distribution panel.

